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A DESTRUCTIVE LOCAL STORM NEAR PARIS, ILL.

By Dr. E. O. LAUGHLIN. Dated Paris, Ill., June 2, 1906.

About 10 p. m., Wednesday, May 30, there occurred in this locality a notable storm, which, while evincing much of the destructiveness within a small area and many of the freaks of a tornado, yet seems to have lacked the twisting motion.

The morning of the 30th was ushered in by a gentle shower. At 7 a. m. the temperature was 52° F., the barometer reading 29.95 and the wind direction southeast. During the day the temperature increased to a maximum of 84° F. and the wind became almost a gale, while the barometer remained stationary. Light showers occurred at intervals.

At 6 p. m. a violent thunderstorm came up from the northwest, with some wind and much lightning. The clouds were quite threatening, flying in different directions, tumbling and intermingling in a way suggestive of the tornado. No damage was done by this storm, however, and by 8 o'clock the sky was again serene, except for a cloud bank in the northwest, from which came constant flashes of lightning.

At 10 p. m. another electric storm broke, accompanied by vivid lightning and some wind and hail, but doing no great amount of damage here in the city. Six miles southwest of here this storm developed a destructive intensity. A modern, strongly built schoolhouse was completely demolished and its foundation swept clean. Immediately southwest of this schoolhouse was a grove of some twenty acres; most of the trees in this grove were blown down, many of them being second-growth hickories, eight or ten inches in diameter. Half a mile east of the schoolhouse a large residence was badly wrecked, a smokehouse some twelve feet square having been hurled bodily against it, crushing in one entire side. This house was also struck twice by lightning during the storm, yet none of its inmates were injured.

A dozen other houses in the path of the storm were more or less damaged, some being only unroofed, while others were moved off their foundations or destroyed.

The storm came from the northwest, and a careful survey of the area of destruction, which comprises a path one-half mile wide and some two miles long, shows no evidence of any whirling or twisting force. An old abandoned school building, 60 feet west of the wrecked schoolhouse, was very slightly injured. A coal shed just north of the schoolhouse was moved some ten feet, but not damaged. This coal shed is interesting as showing the terrific force of the hail which accompanied the storm. Every square inch of the surface of its west wall, composed of hard pine, has been battered and indented, frequently to the depth of a quarter of an inch; the shingle roof also shows these imprints.

This storm seems unusual for its concentrated destructiveness without any whirling action, and for the fact that it came from the northwest and that the barometric pressure during its passage was not low. As no weather map was issued for Decoration Day, I do not know the general conditions. The chart for the following day[1] shows a low central at Duluth, Minn., with a pressure of 29.75 inches and a trough-like depression extending into Texas.

THE KODAIKÁNAL SOLAR PHYSICS OBSERVATORY.

By HERBERT H. KIMBALL, Librarian, Weather Bureau.

The establishment of this observatory marks another step forward in the persistent efforts of the government of India to find the relation that is supposed to exist between solar processes and meteorological conditions on the earth.

As early as 1881, Mr. Blanford, then Meteorological Reporter to the government of India, recommended "the improvement of the work of solar observations in order to obtain accurate measures of the sun's heating power at the earth's surface and its periodic variations ".[1]

[1] The weather map for the day following, showing conditions at 7 a. m., central standard time, only about nine hours after the storm occurred, probably presents more nearly the conditions at the hour when the storm came than the map of the day itself would do.—EDITOR.

[1] Report on the Administration of the Meteorological Department of the government of India in 1900-1901, p. 19.

At that time solar physics investigations were being conducted by two independent branches of the government. The work of photographing the solar disk was carried on under the direction of the Surveyor General, at Dehra, while the Meteorological Department undertook actinometric work, measurements with solar radiation thermometers, and observations of the temperature of the ground.

Observations with a Balfour Stewart actinometer were commenced at the Alipur Observatory, near Calcutta, in November, 1879, at the suggestion of the commission which was appointed to inquire into the disastrous Madras famine of 1876–77. The character of the results obtained indicated that the skies at Alipur were not favorable for solar radiation measurements. An actinometer of the same pattern was therefore sent in 1881 to Mussooree on the summit of one of the foothills of the Himalaya Mountains at an elevation of about 6700 feet.

The observations at this latter station not proving satisfactory, owing, it was assumed, to the almost constant presence of haze in the atmosphere, it was determined to transfer the actinometer to Leh, in the heart of the Himalaya Mountain region, at an elevation of about 11,500 feet. Observations were commenced at this point in November, 1883, but the state of the sky was so disappointing that they were discontinued in October, 1885. During twenty-three months of observing but 60 complete daily series, consisting of double determinations of the radiation at noon, two hours before noon, and two hours after noon, were obtained. On seven days, however, the observations extended over a much longer time than the four hours embraced in a regular daily series.

Upon the return of the instruments and observers from Leh, actinometer observations were resumed at Mussooree. They were so unsatisfactory, however, owing to the frequency of clouds during the wet season and haze during the dry season, that in March, 1889, the actinometer was transferred to Simla, also in the Himalaya foothills, at an elevation of about 7200 feet. Here observations were maintained up to 1898, but on account of adverse meteorological conditions not much value was attached to them, and but few observations were made after November, 1895.

All observations made previous to this date were forwarded for discussion to the Solar Physics Committee of the British Association for the Advancement of Science, but a report upon them has not yet been published.

Meanwhile the government of India had decided to erect a new solar physics observatory at Kodaikánal, on a small plateau in the Palani Hills, in southern India, and to bring together there, under the direction of the Meteorological Department, the various branches of solar physics investigation heretofore carried on under the direction of different departments of the government. The transfer took effect on April 1, 1899, and C. Michie Smith was appointed director of the observatory.

The coordinates of the observatory are approximately as follows:

Latitude, 10° 14′ N.; longitude, 77° 30′ E.; elevation, 7688 feet.

The climate seems to be well adapted to most solar physics work, since we learn from the report of the director that in 1904 there were only 22 days on which observations of some kind could not be made on the sun. From the same source we learn, however, that there are few days when the sky is sufficiently free from haze to permit of actinometric work. The Nilgiris Mountains, distant about eighty miles, are visible about half the time.

From the standpoint of comfort the climate seems to be all that could be desired, since the extremes of temperature for the years 1899–1905 are 77° F. for the maximum and 39° F. for the minimum. The relative humidity is very low, frequently falling below 10 per cent.

The greatest daily wind movement recorded is 991 miles, and special precautions are necessary to prevent vibrations of the instruments from wind effects.

The average number of days with rain during the year is 118, early afternoon showers being frequent at certain seasons of the year. The average annual rainfall is about 60 inches.

The observatory grounds embrace about 100 acres, mostly bare rock, or grass covered ground. To reduce as far as possible the convectional currents arising from this character of surface, many thousands of young trees have been raised for planting about the grounds, mostly from the seed of pines indigenous to the hills in southern California.

Fig. 1 is a reproduction of a photograph of the observatory, recently received.

The principal buildings are as follows: Main observatory; spectroheliograph building; photoheliograph house; transit house; magnetic observatory; cottages for director, assistants, and employees. Other buildings are in process of construction.

The equipment is as follows:[2]

Six-inch Cooke equatorial.

Six-inch Lerebour and Secretan equatorial, remounted by Grubb with a 5-inch Grubb portrait lens of 36 inches focus attached.

Spectrograph, consisting of an 11-inch polar siderostat, 6-inch Grubb lens of 40 feet focus, and a 4-inch concave grating of 10 feet focus, mounted on Rowland's plan. A plane grating with collimator and camera lenses of 8 feet focus can be substituted for the concave grating.

A rhomb, with ends cut at 45°, mounted on a graduated circle, can be placed in front of the slit so as to enable any part of the limb to be brought on to the slit.

Six-inch transit instrument and barrel chronograph, formerly the property of the Great Trigonometrical Survey of India.

Six-prism table spectroscope, Hilger.

Photoheliograph, Dallmeyer No. 4.

Theodolite, 6-inch, Cooke.

Two phototheodolites by Steinheil for cloud photography.

Sextant.

Spectroheliograph with 18-inch siderostat and 12-inch Cooke triple achromatic lens of 20 feet focus, by the Cambridge Scientific Instrument Company, limited.

Evershed spectroscope with three prisms for prominence and sun-spot work, Hilger.

Mean time clock, Kullberg 6326.

Sidereal clock, Shelton.

Mean time chronometer, Kullberg 6299.

Sidereal chronometer, Kullberg 6134.

Tape chronograph, Fuess.

Micrometer for measuring spectrum photographs, Hilger.

Dividing engine, Cambridge Scientific Instrument Company, limited.

Two Balfour Stewart actinometers.

Buchanan's solar calorimeter.

Induction coil with necessary adjuncts.

Small polar siderostat.

Universal instrument.

Complete set of meteorological instruments, including Richard barograph and thermograph, and wind recorders.

The following program of observations, laid down by the Observatories Committee of the Royal Society, has been adopted:[3]

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[2] Annual Report of the Director, Kodaikánal and Madras Observatories, 1905, pp. 2, 3.

[3] Annual Report of the Director, Kodaikánal and Madras Observatories, 1903, p. 3.

FIG. 1.—The Solar Physics Observatory, Kodaikánal, India, 1905.

Solar physics—

(*a*) Observations of the six most widened lines in sun-spot spectra between *F* and *b*, and other six between *b* and *D*.

(*b*) Observations of the other widened lines in sun-spot spectra.

(*c*) Visual observations of prominences and chromosphere.

(*d*) Photographs of solar disk in monochromatic light.

(*e*) Photographs of sun-spot spectra.

Meteorological observations—

(*f*) Complete.

Other observations—

(*g*) Actinometry.

(*h*) Earthquake records.

(*i*) Cloud observations.

Magnetic observations—

It will be noticed that the above program does not include magnetic observations, and the list of instruments does not include the equipment of the magnetic observatory. From the Annual Report of the Director for 1904 we learn, however, that the following complete records are taken:

(*a*) Visually with the magnetometer and dip circle.

(*b*) By continuous photographic registration with a Watson magnetograph recording horizontal intensity and declination.

A base station is maintained at Periyakulam, three and one-half miles from the foot of the hills, or ten miles from Kodaikánal, at an elevation of about 935 feet, where a complete set of meteorological records is obtained.

The following publications of the observatory have been received at the Weather Bureau Library:

Annual Reports of the Director, Kodaikánal and Madras observatories, 1899–1905.

Kodaikánal Observatory, Bulletin No. I. Widened lines of sun-spot spectra.

The publication of the following bulletins has been announced:

No. II, containing a list of prominences observed between September 1, 1903, and December 31, 1904.

No. III, giving an account of the observations of D_3 as a dark line in the solar spectrum.

No. IV, which brings the record of sun-spot spectra up to the end of June, 1905.

Since January, 1903, the Indian Monthly Weather Review has contained in each issue a report from the Kodaikánal Observatory on the solar and magnetic disturbances of the month. In this report, as in the bulletins, special attention is paid to sun spots and prominences.

Important results are to be expected from an observatory organized on such broad lines. Its connection with the Meteorological Department of the government of India is but additional evidence of the broader field that is to be covered by the science of meteorology in the future. It is to be hoped that the rather discouraging experiences with the Balfour Stewart actinometer will not entirely prevent systematic measurements of solar radiation at the Kodaikánal Observatory, since other apparatus can undoubtedly be found.

HAWAIIAN MOUNTAIN RECORDS.

A letter from Prof. Dr. Julius Hann, dated December 2, 1905, calls attention to the fact that meteorology greatly needs observations from very high stations in the Hawaiian Islands.

You now have a station on Hawaii. This should give an opportunity for the determination of the circulation of the atmosphere at latitude 19° north, in about the middle of the ocean, that would be of the highest value. You can also observe the upper currents of air regularly, instead of occasionally, as is done in scientific expeditions like that of Hergesell and the Prince of Monaco. The existing observations made on Mauna Loa and Mauna Keua, at altitudes of about 4000 meters, give the same result as those made on the peak of Teneriffe, and can not be greatly influenced by local irregularities, as those obtained by Hergesell were influenced by the African Continent. I know that a long series of obser-